AGENCY OF NATURAL RESOURCES

DEPARTMENT OF FORESTS, PARKS AND RECREATION

STATE OF VERMONT

FOREST INSECT AND DISEASE CONDITIONS
NORTHERN REGION

CALENDAR YEAR 1987

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INTRODUCTION

The information in this report is based largely on aerial surveys to detect defoliation, dieback, and mortality, as well as ground surveys and observations of forest resource protection personnel and other forestry and department staff.

Aerial surveys were flown in August (Districts III and IV) to the first week in September (District III) to detect dieback and mortality as well as any insect defoliation. No defoliation was visible except for that caused by birch leaf miner and associated insects on birch, particularly white and gray birch.

WEATHER SUMMARY

While the summer of 1986 was cold and wet, the 1987 growing season was predominantly drier and warmer than normal. May was the driest since 1982 for most of the region, with "moderate drought" (Palmer drought severity index) and temperatures slightly above normal. June precipitation was above normal, with temperatures slightly above normal. July precipitation was near normal in all regions while temperatures were above normal. August had near normal temperatures but precipitation dropped again to well below normal amounts in all regions. Frosts occurred on 10 days in May but were not heavy enough to cause widespread damage, although heavy damage occurred in one Bakersfield Christmas tree plantation and light damage to trees and flowers was common. Even more unusual, scattered light frosts occurred during the months of June, July and August. A severe hailstorm in May damaged plants in several Chittenden County communities and another one in July caused moderate to heavy defoliation of hardwoods in Roxbury. An unusual early snowstorm on 4 October dropped two to six inches of wet snow over much of the region, but since many of the leaves had already dropped and snowfall was not as heavy as further south in the state, tree damage was mostly light and scattered, unlike the severe damage that occurred in Bennington County.

FOREST INSECTS

Hardwood Defoliators

Birch Leaf Miner, Fenusa pusilla, caused moderate to heavy defoliation of gray and white birch throughout the region, except for light to moderate defoliation in the Champlain Valley. Defoliation was nearly 100 percent following second generation feeding in many areas, particularly Orange County. Here, some crown dieback was evident on otherwise vigorous appearing paper birch that was nearing maturity. The slightly drier and warmer-than-normal season could be an additional stress to birches. This should be considered where cutting of birch is planned during the next few years.

Forest Tent Caterpillar, Malacosoma disstria, larvae were observed more frequently than in 1986. Pheromone traps (five traps per stand) were placed in six sugar maple stands in the state this year, with the addition of plots in Waterville and Barnard. Average moth catch increased for the first time since we began trapping three years ago in the towns of Fairfield, Waterbury, Roxbury and Bethel. Moths per trap averaged about three for these locations compared to 0.6 per trap in 1986 and 1985 (Table 1).

Table 1. Forest tent caterpillar moth catch in pheromone traps - 1985 to 1987.

Location	Average Number of Moths per Trap		
	1985	1986	1987
Roxbury	0.6	0.2	2.0
Fairfield	0.6	0.6	4.8
Bethel	0.6	0.8	2.0
Waterbury	0.6	0.8	2.0 (Hara)
Waterville	-	-	6.6
Barnard	-	-	13.6

Gypsy Moth, Lymantria dispar, caused some light defoliation in focal point areas in Chittenden County and in some residential areas in Colchester, but none visible by aerial survey. Larval counts and egg mass counts were up dramatically for the first time in the past three years, indicating a building population (Table 2).

Table 2. Gypsy moth focal area plots - number of living larvae/pupae (L/P) per plot, number of moths per one pheromone trap, and number of egg masses per plot - 1986 to 1987.

Location	No. L/P per plot* 1986	1987	No. egg masses/plot* 1986	1987	No. moths/trap 1987
Milton	10	89	5	21	127
Colchester	54	598	10	48	193
Middlesex	5	8	0	0	66

*Average for two .045 acre (15m.diameter) plots at peak fifth instar.

Saddled Prominent, Heterocampa guttivata, larvae were more noticeable throughout the region than during the past five years, but there was no noticeable defoliation. However, pupae were numerous enough this fall to be observed wherever soil was disturbed in several locations, including Lincoln, Underhill, and Vershire. This probably indicates increasing populations for 1988 and July surveys for eggs on sugar maple leaves are planned for potential hot spots.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
American Dagger Moth *Acronicta americana*			N.O.
Apple & Thorn Skeletonizer *Anthophila pariana*			N.O.
Birch Leaf Miner *Fenusa pusilla*			See narrative
Birch Leaf Folder *Ancylis discigerana*	Yellow Birch	Lamoille Washington Orange Counties	Light, scattered defoliation
Birch Skeletonizer *Bucculatrix canadensisella*	White Birch Yellow Birch	Lamoille Washington Orange Counties	Light, scattered defoliation
Bruce Spanworm *Operophtera bruceata*			N.O.
Cherry Scallop Shell Moth *Hydria prunivorata*			N.O.
Eastern Tent Caterpillar *Malacosoma americanum*	Cherry Apple	Widespread	Mostly light damage but somewhat more numerous than in 1986
Elm Leaf Beetle *Pyrrhalta luteola*	American Elm Chinese Elm	Scattered throughout	Very low populations

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Fall Cankerworm *Alsophila pometaria*			N.O.
Fall Webworm *Hyphantrea cunea*	Many hdwds. and shrubs, including cherry, apple, and maple	Widespread	Scattered, light defoliation. Highest populations in Connecticut River Valley
Forest Tent Caterpillar *Malacosoma disstria*			See narrative
Green Striped Mapleworm *Anisota rubicunda*	Red Maple Sugar Maple	Scattered-all counties except Lamoille, Washington, and Orange	Scattered individual larvae observed
Gypsy Moth *Lymantria dispar*			See narrative
Half Winged Geometer *Phigalia titea*	Red Oak	Middlesex	A few larvae seen in gypsy moth focal plot
Japanese Beetle *Popillia japonica*	Ornamentals	Chittenden Caledonia Counties	Moderate to heavy defoliation of individual plants
Lace Bugs *Corythucha*	Elm Yellow Birch	Chittenden and Washington Counties Lamoille Orange Orleans Counties	Moderate to heavy defoliation of elm. Light defoliation of yellow birch
Large Aspen Tortrix *Choristoneura conflictana*			N.O.

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS (N.O.=Not Observed)
Leaf Beetle Chrysomelidae Unidentified spp.			N.O.
Linden Looper Erranis tiliaria		Lamoille Orange Washington Caledonia Counties	Occasional larvae observed
Locust Leaf Miner Odontata dorsalis	Black Locust	All areas except Northeast Kingdom	Moderate-heavy defoliation in Orange County; heavy defoliation in Chittenden County
Maple Leaf Cutter Paraclemensia acerifoliella	Sugar Maple	Widespread	243 acres of light defoliation in Chittenden County visible during aerial survey
Maple Trumpet Skeletonizer Epinotia aceriella	Sugar Maple Red Maple	Widespread	Mostly trace to light populations except occasional small areas of moderate defoliation in Lamoille and Orange Counties. Increasing in Orange County
Maple Webworm Tetralopha asperatella	Sugar Maple Norway Maple	Swanton	Light defoliation in Swanton; not observed elsewhere
Mountain Ash Sawfly Prisophora geniculata	Mountain Ash	Scattered throughout	Not as heavy as in recent years
Oak Skeletonizer Bucculatrix ainsliella	Oak spp.	Colchester	Light defoliation in gypsy moth focal plot. Populations increasing over 1986 levels
Orange-humped Mapleworm Symmerista leucitys	Sugar Maple	Scattered throughout	Occasional larvae observed

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS (N.O.=Not Observed)
Pear Thrips *Taeniothrips inconsequens*	Sugar Maple	Widespread	Present in areas previously damaged but only at very light population levels
Pin Oak Sawfly *Caliroa sp.*			N.O.
Red-humped Caterpillar *Schizura concinna*	Crimson King Maple	St.Johnsbury	Moderate defoliation of one tree
Saddled Prominent *Heterocampa guttivata*			See narrative
Satin Moth *Leucoma salicis*	Poplar	Chittenden County and Newport	
Solitary Leaf Roller *Sparganothis pettitana*	Sugar Maple	Addison Chittenden Franklin Counties	Scattered trace populations
Solitary Oak Leaf Miner *Cameraria hamadryadella*	Red Oak	Addison Chittenden Franklin Counties	Light scattered defoliation
Spotted Tussock Moth *Halysidota maculata*			N.O.
Spring Cankerworm *Paleacrita vernata*			N.O.
Uglynest Caterpillar *Archips cerasivoranus*	Cherry	Widespread	Scattered light defoliation similar to 1986

OTHER HARDWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS (N.O.=Not Observed)
Unidentified Leaf Miner	Balsam Poplar	Orange County	Was common in Northeast Kingdom in 1986. Caused occasional heavy defoliation in Orange County this year

Softwood Defoliators

Spruce Budworm, Choristoneura fumiferana, populations continued to drop to extremely low levels in 1987 with no aerially visible defoliation for the fourth consecutive year. No budworm larvae were seen this year and only one of 69 pheromone traps caught any moths.

Pheromone traps were deployed in 19 stands this year compared to 15 in 1986. New plots were established further north in the Northeast Kingdom to include areas near the Canadian border where budworm defoliation was first detected in 1976. Each plot consisted of three to five traps in a cluster, using the same lure and trap as in 1986. But, only one moth in one trap in Hardwick was caught this year, resulting in an average moth catch per trap, per plot of 0.01 moths compared to 1.2 moths in 1986. This corresponds to extremely low numbers of overwintering larvae (0.4 per 100ft^2 of foliage) found in the fall of 1986.

Balsam fir defoliation, based on a Fettes evaluation of five branches per stand for 19 stands, averaged only 0.4 percent compared to 0.7 percent in 1986 and two percent in 1985. At this point, it is difficult to say that spruce budworm is responsible for the small amount of defoliation observed.

Overwintering larvae were soaked out of five branches per plot for each of the 19 pheromone plots in the fall of 1987. Population levels for 1988 remain very low in widely scattered locations (Table 3). Up until the recent standardization of pheromone traps, counts of overwintering larvae soaked out of whole branches have been our most sensitive and consistent survey method. Table 3 shows the dramatic drop in population levels that has occurred since the height of the infestation in 1981.

Table 3. Average number of overwintering (L_2) spruce budworm larvae per 100 square feet of foliage for all plots surveyed - 1981 to 1987

Year						
1981	1982	1983	1984	1985	1986	1987
	-No. of larvae per 100ft^2 of foliate*-					
1040	385	140	95	7	0.4	1.4

*It takes at least 100 larvae per 100ft^2 of foliage to result in moderate defoliation (30%).

Stands containing spruce-fir mortality from past budworm damage remain visible from the air. The annual aerial survey detected 12,641 acres of mortality (Table 4), down only slightly from the 14,045 acres detected in 1986.

Table 4. Acres of mortality visible in 1987 due to past spruce budworm defoliation.

	Acres of mortality*			
County	Light	Moderate	Heavy	Total
Caledonia	206	1,369	1,765	3,340
Essex	67	2,197	2,507	4,771
Orleans	218	1,918	2,394	4,530
Total	491	5,484	6,666	12,641

*Light mortality = 1-10%, scattered or patchy
Moderate mortality = 11-25%, scattered
Heavy mortality = over 25%

A resurvey of 11 permanent ground plots in budworm-damaged stands showed that annual balsam fir tree mortality averaged 0.0, 0.5, and 1.0 percent, respectively, for formerly heavily, moderately, and lightly damaged stands, compared to 6.8, 4.5, and 3.2 percent in 1986. Applying these data to acres of mortality from Table 4 results in a total volume loss of 797 cords, representing 7,436 dead trees. Current mortality cannot all be attributed to budworm and probably does not exceed background mortality from other causes. The 1973 Forest Inventory of Vermont, completed prior to the most recent budworm outbreak, reported an annual mortality rate of 1.5 percent of the growing stock volume for balsam fir.

Scattered balsam fir trees left with small crowns as the result of past budworm damage, exhibited pitch flow from recent bark beetle attacks in many of the stands surveyed. The beetle, probably the balsam fir bark beetle, Pityokteines sparsus, was unsuccessful in colonizing some of the trees, but others were well infested by early fall even though most trees were not yet dead. This is likely to result in a slight increase in future balsam mortality in these stands.

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Arborvitae Leaf Miner *Argyresthia thuiella*	Arborvitae Northern White Cedar	Scattered throughout	Mostly light defoliation, some heavy damage to ornamentals in Barre and Stowe
Introduced Pine Sawfly *Diprion similis*	White Pine Scots Pine	Widespread	Not observed on ornamentals this year but light infestations on white pine (98 acres) and Scots pine (112 acres) Christmas trees were about as common as in 1986
Larch Casebearer *Coleophora laricella*	European Larch	Chittenden Lamoille Orange Counties	Light but increasing populations
Larch Sawfly *Pristophora erichosonii*			N.O.
Nursery Pine Sawfly *Diprion fruteorum*			N.O.
Pine Nesting Sawfly *Acantholyda zappei*	Scots Pine	Williston	Trace of damage
Pine Webworm *Tetralopha robustella*	Scots Pine	Lincoln	Light damage in a Christmas tree plantation
Red Headed Pine Sawfly *Neodiprion lecontei*			N.O.
Spruce Budworm *Choristoneura fumiferana*			See narrative

OTHER SOFTWOOD DEFOLIATORS

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Spruce Bud Moth *Zeiraphera canadensis*	White Spruce	Caledonia County Craftsbury Berkshire Wolcott	Scattered trace damage; mostly light damage to Christmas trees
White Pine Sawfly *Neodiprion pinetum*	White Pine	Eden	Two, 15-foot tall pines completely defoliated. First time in many years that heavy defoliation by this insect has been observed
Yellow-headed Spruce Sawfly *Pikonema alaskensis*	Blue Spruce	Barre	Some defoliation

Sapsucking Insects, Midges and Mites

Lecanium Scale, Lecanium spp., was detected in significant numbers in the region for the first time this year. It was common on red oak, sugar maple, and beech in scattered locations throughout the district. Heaviest populations were found within scattered red oak stands and on red oak ornamentals.

Oystershell Scale, Lepidosaphes ulmi, was detected in more locations throughout the region than last year and was especially common on beech in Orleans County. Severe damage to beech in stands where it comprises a large percentage of the species composition continues, but populations within Chittenden County stands evaluated for population levels were down dramatically compared to 1986. A noticeable increase in 1987 shoot length on infested beeches was evident in comparison with growth during the previous three years. Light populations of the scale were evident on other associated hardwoods, including sugar maple and yellow birch.

OTHER SAPSUCKING INSECTS, MIDGES & MITES

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Aphids Cinara sp.	Balsam Fir White Pine	Bakersfield Morristown	Moderate damage to balsam fir Christmas trees; heavy on ornamental white pine
Aphids Many unidentified species	Many	Widespread	Heavy populations of many aphids this year
Balsam Gall Midge Paradiplosis tumifex	Balsam Fir	Widespread	Only trace to light populations on Christmas trees but increasing compared to 1986
Balsam Twig Aphid Mindarus abietinus	Balsam Fir	Widespread	Mostly light to moderate Christmas tree damage. Populations up in some plantations and down in others, but overall, little change from 1986 levels. Moderate damage recorded for 128 acres out of 343 Christmas tree acres where twig aphid was detected
Balsam Woolly Aphid Adelges piceae			N.O.

OTHER SAPSUCKING INSECTS, MIDGES & MITES

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Beech Scale			See Beech Bark Disease
Cooley Spruce Gall *Adelges cooleyi*	Blue Spruce	Barton Essex	Light damage
Eastern Spruce Gall Aphid *Adelges abietis*	Red Spruce White Spruce	Widespread	Remains common; heavy damage to ornamental white spruce in Randolph and Corinth
Lecanium Scale *Lecanium sp.*			See narrative
Norway Maple Aphid *Periphyllus lyropictus*	Sugar Maple	Widespread	Unusually heavy, especially in Chittenden County maple stands and sugarbushes
Oystershell Scale *Lepidosaphes ulmi*			See narrative
Pear Thrips *Taeniothrips inconsequens*	Sugar Maple	Widespread	Present in areas previously damaged, but only at very light population levels
Pine Bark Aphid *Pineus strobi*	White Pine	Widespread	Remains common
Pine Fascicle Mite *Triseticus alborum*	White Pine	Widespread	Trace to light shoot damage observed
Pine Leaf Adelgid *Pineus pinifoliae*	White Pine	Widely scattered	Some adults observed on white pine needles but not numerous and damage down from 1986
Pine Needle Midge *Contarinea baeri*	Scots Pine	Addison County	Light damage throughout a Christmas tree plantation in Lincoln; trace damage common elsewhere
Pine Needle Scale *Phenacapsis pinifoliae*	Scots Pine	Middlebury	Infesting one Christmas tree plantation

OTHER SAPSUCKING INSECTS, MIDGES & MITES

INSECT	HOST(S)	LOCALITY	REMARKS (N.O.=Not Observed)
Pine Spittlebug *Aphrophora parallela*	White Pine Scots Pine Red Pine Balsam Fir	Widespread	
Pine Thrips *Gnophothrips sp.*	Scots Pine	Lincoln	Moderate damage to scattered Christmas trees
Root Aphid *Prociphilus americanus*	Balsam Fir Fraser Fir	Lamoille County	No new locations found; damage lessening
Spruce Spider Mite *Oligonychus ununguis*	Fraser Fir Balsam Fir Red Spruce White Spruce	Widely scattered	Scattered moderate to heavy damage to Christmas trees, particularly Fraser Fir, similar to 1986. Numbers of mites can increase dramatically on infested trees by mid-summer so it's best to monitor for mites in June when the new growth has expanded and apply controls then if mites are present. Spray trials with Omite and Savey (not yet registered for fir Christmas trees) showed both materials to be an effective alternative to Kelthane
White Pine Needle Midge Unknown species, possibly *Cecidomyia pinifoliae*	White Pine	Walden Brookfield	Heavy needle droop and defoliation of scattered Christmas trees

BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS (N.O.=Not Observed)
Balsam Shootboring Sawfly *Pleroneura bruneicornis*	Balsam Fir	Berkshire Morristown	Only very light damage to Christmas trees detected

BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Bronze Birch Borer *Agrilus anxius*	White Birch	Essex	One tree affected
Butternut Curculio *Conotrachelus juglandis*	Butternut	Jericho	
Ghost Moth *Korsheltellus gracilis*	Red Spruce Balsam Fir	Scattered	See narrative
Maple Peticle Borer *Caulocampus acericaulis*	Sugar Maple	Franklin Chittenden Addison Lamoille Counties	Light damage, down from 1985 levels
Northern Pine Weevil *Pissodes approximatus*			N.O.
Northern Pitch Twig Moth *Petrova albicapitana*			N.O.
Pales Weevil *Hylobius pales*	Scots Pine	Widespread in northern Vermont	287 acres of mostly light damage to Christmas trees detected; little change from 1986
Pine Gall Weevil *Podapion gallicola*	Red Pine	Thetford	Light damage to mature pine at Thetford State Forest
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar Maple Seedlings	Franklin Chittenden Addison Orleans Counties	Scattered light mortality of seedlings
Poplar Petiole Gall *Ectoedemia populela*			N.O.

BUD, SHOOT & STEM INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS (N.O.=Not Observed)
Round-headed Apple Tree Borer *Saperda candida*	Apple Mountain Ash	Caledonia County	Numerous shade tree calls
White Grubs *Phyllophaga sp.*	Various conifers	Essex	Continuing to cause some seedling mortality at state tree nursery
White Pine Weevil *Pissodes strobi*	White Pine Scots Pine Blue Spruce Norway Spruce White Spruce Red Spruce	Widespread	Remains common; heavy damage to a Norway spruce stand in Albany. Unusual top kill of red spruce in Lewis. Light damage to 70 acres of Scots pine and 115 acres of white pine Christmas trees

Root Insects

The Conifer Swift Moth, *Korsheltellus gracilis* (formerly *Hepialis gracilis*), formerly called the Ghost Moth, continues to be found associated with feeding wounds on the roots of balsam fir and red spruce at high elevations. Dave Wagner, the North American authority on this group, is heading up a research project on this insect at the University of Vermont. Larval density at 3400 feet elevation on Camels Hump averaged 40 per square meter or 160,000 per acre this summer. Dave found similar densities of the insect on three other Vermont mountains as well as on Whiteface Mountain in New York and Mt. Mooselauke in New Hampshire. Preliminary results from feeding assays show that early instar larvae will gain weight when fed exclusive diets of either spruce, fir or moss, especially the latter. Although late instar larvae are more common on tree roots, their food preference has not yet been determined. Exclusion experiments in the field, containing planted spruce with and without larvae around the root ball, were conducted this year but the results have not yet been analyzed. Other experiments planned include feeding preference tests with late instar larvae, determination of adult emergence and parasitism rates, and correlations of severely damaged spruce-fir zones with density of larvae.

BARK BEETLES

INSECT	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Balsam Fir Bark Beetle Unidentified, probably *Pityokteines sparsus*	Balsam Fir	Northeast Kingdom	Commonly attacking trees previously weakened by spruce budworm
Eastern Larch Beetle *Dendroctonus simplex*	Eastern Larch	Widespread	Associated with larch decline
Elm Bark Beetles *Hylurgopinus rufipes* *Scolytus multistriatus*	American Elm	Widespread	See Dutch Elm disease

FOREST DISEASES

Stem Diseases

Beech Bark Disease, caused by Cryptococcus fagisuga and Nectria coccinea var. faginata, continues to be more evident. With an increase in beech scale populations during the past few years, Nectria fruiting is now becoming more prevalent in stands containing beech, and yellowing crowns from infected trees are more numerous. Data from the Vermont Hardwood Tree Health Survey on dominant/codominant trees show that mortality from past infection was fairly low in 1986 (1.6 percent dead), but 11 percent of the beech trees were severely declining (with more than 50 percent crown dieback), and only 55 percent were healthy. Only American elm had a lower percentage of trees healthy. Not all the dieback is due to beech scale....Nectria, Lecanium scale and Oystershell scale, particularly the latter, is contributing to the observed crown dieback.

Butternut Canker, caused by Sirococcus clavigignenti-juglandacearum, was found to be the cause of heavy mortality in one stand in Berlin (Washington County) discovered late in 1986 and has since been detected causing dieback and mortality of butternut in Craftsbury (Orleans County) and Lyndon (Caledonia County).

Dutch Elm Disease, caused by Ceratocystis ulmi, caused a greater than usual amount of mortality again this year. According to U.S. Forest Service Pathologist Dave Houston, an aggressive strain of the fungus is becoming more abundant in the state and is likely responsible for the increase in elm mortality. The 1986 Vermont Hardwood Tree Health Survey estimated that 34 percent of the dominant/codominant American elms in the state were dead, excluding snags. Most of this mortality was due to Dutch elm disease.

Scleroderris Canker, caused by Ascocalyx abietina (formerly Gremmeniella abietina), was not found in any previously uninfected plantations this year during a survey of 53 Christmas tree plantations and 134 red and Scots pine plantations. New infections were difficult to find in many of the plantations that were heavily infected in the past. This is the first year since 1983 that no new towns will have to be added to the quarantine area.

The pine Christmas tree plantations were insepcted within 28 towns inside the quarantine area and the larger red and Scots pine plantations were surveyed in 28 towns just outside the 1986 quarantine zone.

Scleroderris infection was scarce in the 1984 planting of white pine seedlings at Lyndon State Forest that averaged 12 percent infection in 1986 and 29 Percent infection in 1985. Recent infection of previously heavily infected understory Scots and white pine here was also extremely light.

The total number of plantations in the state known to be infected remains at 124, consisting of 106 red pine and 18 Scots pine plantations (Figure 2). This represents 842 and 150 acres, respectively, for a total of 992 acres infected. Another six plantations were infected at one time, but have since had the disease eradicated or the trees cut.

White Pine Blister Rust, caused by Cronartium ribicola, was responsible for white pine Christmas tree mortality on about the same acreage as in 1986 (109 acres), but more moderately damaged plantations (53 acres) were detected. The Vermont Department of Agriculture and University of Vermont are cooperatively testing popular cultivars of Ribes to determine resistance to blister rust. Four varieties have been tested, with another 10 planned for 1988, but so far, none have exhibited complete resistance to infection.

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Beech Bark Disease Cryptococcus fagisuga and Nectria coccinea var. faginata			See narrative
Caliciopsis Canker Caliciopsis pinea	White Pine	Widespread-heaviest in Orange County	Heavy resin flow on heavily infected trees, resembles white pine blister rust. Supposed to be most common on stagnated trees. No mortality yet observed
Cytospora Canker Leucostoma kunzei	Blue Spruce	Widespread	Common on ornamentals
Diplodia Shoot Blight (or Shaeropsis Shoot Blight) Diplodia pinea (Sphaeropsis pinea)	Austrian Pine Mugho Pine Scots Pine Red Pine	Essex Morrisville Barre	Killed a large mugho pine ornamental in Morrisville
Dutch Elm Disease Ceratocystis ulmi			See narrative
Eastern Dwarf Mistletoe Arceuthobium pusillum	Red Spruce		No new locations discovered

OTHER STEM DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Fireblight *Erwinia amylovora*	Mountain Ash Crabapple	Widespread	Common again this year. Intensity increased by fertilization
Hypoxylon Canker *Hypoxylon pruinatum*	Quaking Aspen	Throughout	Light to moderate mortality
Oak Wilt *Ceratocystis fagacearum*	Oak species	Negative surveys statewide	No suspects detected during annual aerial survey
Sapstreak *Ceratocystis coerulescens*	Sugar Maple	Coventry	Confirmed by Dave Houston as the cause of dieback of one sugarbush tree. Sapstreak symptoms common in Washington and Orange Counties but causal agent not confirmed
Scleroderris Canker *Gremmeniella abietina*			See narrative
Sirococcus Shoot Blight *Sirococcus strobilinus*	Red Pine	Plainfield	Strongly suspected as the cause of regeneration mortality in Jones' State Forest
Verticillium Wilt *Verticillium albo-atrum* or *V. dahlia*	Sugar Maple	Craftsbury	Killed an ornamental
White Pine Blister Rust *Cronartium ribicola*			Causing moderate damage to 53 of 109 acres of Christmas trees compared to 19 of 88 acres in 1986
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine	Widespread	Detected in 15 Christmas tree plantations comprising 232 acres. About 100 acres had heavy shoot and branch mortality similar to 1986

Foliage Diseases

Foliage diseases that were very common during the past few years were much reduced this year, with a return to drier weather.

DISEASE	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Anthracnose *Gloeosporium spp.*	Sugar Maple	Lamoille Washington Orange Counties	Light damage only
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Eastern Red Cedar Apple	Chittenden	More reports than in 1986
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Widespread	Christmas tree damage remains widespread but mostly light
Fir-Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Widespread	Dropped to very light levels in Christmas tree plantations this year
Lophodermium Needlecast *Lophodermium pinastri*	Scots Pine	Widespread	Mostly light damage to Christmas trees, similar to 1986 levels
Rhabdocline Needlecast *Rhabdocline pseudotsugae*	Douglas Fir	Scattered	Occasionally heavy damage in Christmas tree plantations
Rhizosphaera Needlecast *Rhizosphaera kalkhoffi*	Blue Spruce	Widely scattered	Causing light to moderate needle loss in a few Christmas tree plantations. Not increasing
Swiss Needlecast *Phaeocryptopus gaumani*	Douglas Fir	Widespread	Causing heavy damage to scattered Christmas tree plantations. More common than Rhabdocline, especially in the northern and central portions of the region

FOLIAGE DISEASES

DISEASE	HOST(S)	LOCALITY	REMARKS(N.O.=Not Observed)
Tar Spot *Rhytisma acerinum* *Rhytisma punctatum*	Red Maple Silver Maple Sugar Maple		Not detected despite abundance in 1986

Root Rots

Annosus Root Rot, caused by *Heterobasidion annosum*, was found in one new location, causing mortality of red pine in a small area of Jones' State Forest in Plainfield.

Shoestring Root Rot, caused by *Armillaria spp.*, continues to be common on declining trees. It was also found to be killing scattered balsam fir Christmas trees within plantations in Johnson and Walden. The problem usually occurs where trees are adjacent to stumps, particularly hardwood stumps. Where this is a problem of seedlings next to stumps of cut Christmas trees, interplanting of seedlings prior to cutting of nearly mature adjacent trees should reduce the mortality. This allows the new seedlings to become established before Armillaria becomes abundant in new stumps, making them more resistant. Some additional armillaria mortality was discovered among the white pine seedlings planted in 1984 at Lyndon State Forest. Armillaria infection of scattered seedlings first became noticeable here in 1986, associated with stumps of cut pines.

DIEBACKS, DECLINES & ENVIRONMENTAL DISEASES

Hardwood Decline of a number of species remains a major concern in the state. Over 2000 acres of hardwood decline were detected in Caledonia, Essex, and Orleans Counties during the annual aerial survey, but most of this was associated with past logging (Table 3, Figure 3). Declining trees had either been damaged during logging or were cull trees that had been left because of their poor quality. Most of the cull trees had decay present at the time of logging.

Table 5. Acres of hardwood dieback and mortality

County	Associated with logging	Not associated with logging	Total
Caledonia	308	94	402
Essex	1,285	39	1,324
Orleans	485	220	705
Total	2,078	353	2,431

Hardwood decline areas not associated with logging were either sugarbushes, areas previously defoliated by forest tent caterpillar, or areas containing a lot of beech dieback due to scale insects and Beech Bark disease.

A statewide hardwood tree health survey was conducted in 1985 and 1986 based on photo interpretation and ground measurements. Twelve thousand acres were estimated to have moderate to heavy mortality (more than 10 percent of the canopy trees dead). This represents 0.5 percent of the 2.5 million acres of hardwood cover type. Dominant/codominant hardwood trees averaged 77.3 percent healthy, 15.7 percent moderately declining (11 to 50 percent of the crown dead), 4.6 percent severely declining (with more than 50 percent of the crown dead) and 2.4 percent dead. Number of dominant/codominant trees dead averaged 3.1 per acre for all hardwoods and 4.1 per acre for all species within hardwood stands.

Mortality of dominant/codominant trees was greatest for American elm (34.2%), followed by spruce (14.1%), balsam fir (10.6%), yellow birch (7.5%) and paper birch (6.1%). Dominant/codominant sugar maple and red maple each averaged less than one percent of the trees dead.

Most hardwoods, including sugar maple, had more than 80 percent of the trees with crowns rated as healthy. However, American elm (47.8%), American beech (54.5%), and yellow birch (69.9%) were well below average in percentage of trees rated healthy.

The number and volume of dead trees is not considered alarming and appears similar to that reported in past surveys. However, nearly 21 percent of all living dominant/codominant hardwoods had crown dieback in excess of 10 percent. This seems higher than expected, but most of this dieback is light enough that the trees should be able to recover if environmental stresses are reduced.

Additional data from the survey specific to certain tree species can be found under Beech Bark Disease, Dutch Elm Disease, Birch Decline, and Red Spruce Decline in this report.

This survey provides the baseline data against which future survey results can be compared so that conclusions on tree condition trends can then be made. A report on the survey results has recently been completed and is available from the Department.

Ash Dieback remains common throughout the state. A research team from New York State College of Forestry at Syracuse found that ash yellows, caused by a mycoplasma-like organism, was commonly associated with dieback throughout much of the state. In this region, however, it was not found outside of the Champlain Valley. Ash dieback is most common in the Champlain Valley, with some dieback in the central part of the region, and very little dieback in the Northeast Kingdom. No increase over 1986 levels was detected.

Birch Decline continues to be evident, particularly in the northern part of the region. White birch appeared to be the most affected in Lamoille, Washington, and Orange Counties, while yellow birch was the primary species affected in the Northeast Kingdom. Statewide, nearly 20 percent of the dominant/codominant yellow birch, and eight percent of the paper birch trees were severely declining (over 50 percent of the crown dead) or dead in 1986, according to the Vermont Hardwood Tree Health Survey. This may be related to weather conditions between 1978 and 1982 when growing season temperatures were generally above average and annual precipitation was below average in Vermont. The effect of the cold, snowless winter of 1980-81 on the shallow root systems of birch may also be a factor. At any rate, a survey of yellow birch condition in Essex County revealed that many trees had improved since 1986.

Frost Damage occurred again this year from several late May frosts, but damage was much lighter than in 1986. Some nursery beds at the state tree nursery in Essex received significant damage. Frost damage to forest stands was most prevalent at higher elevations in the Northeast Kingdom. Here, some pockets of damage were visible in Caledonia County. Frost injury to balsam fir Christmas trees was recorded for 24 plantations, comprising 308 acres. Damage was mostly light to moderate except for a 20 acre plantation in Bakersfield that was heavily damaged. The cumulative effect of damaging the same trees that were heavily damaged last year in some locations resulted in some very poor-looking trees that will require at least another year to recover.

A hail storm on 31 May, with 50 mph winds and two-inch hailstones damaged plant shoots in Williston, Essex, and Jericho. Another such storm in late July caused moderate to heavy defoliation of over 40 acres of hardwood in the Cram Hill area of Roxbury State Forest.

Herbicide Injury to scattered ornamentals was reported in urban areas of Chittenden County, mostly due to the use of Scotts +2.

Improper Planting was the primary cause of numerous shade tree problems and some highway interchange plantings in Caledonia County as well as some scattered Christmas tree plantings throughout the region.

Larch Decline appears to be expanding in many stands with previous decline, following several years of decreasing intensity. Increasing damage was most noticeable in Orange, Caledonia, Orleans, and Essex Counties and may be related to the dry summer weather. Fifty-three acres of larch decline were aerially mapped in the Northeast Kingdom but actual acreage exceeds this amount.

Maple Decline continues to be a concern to sugarbush owners, shade tree owners, and other woodlot owners. Ninety-one acres of sugarbush decline was reported for Orleans County, but most of this was attributed to improper sugaring practices. A variety of stress factors can be identified in most problem areas, including soil drainage, weather factors due to topography and aspect, past defoliation, site and stand character changes, poor sugaring practices, and off-site and improper planting practices. Many trees that exhibited dieback during the recent past appeared to be recovering this year. A laboratory examination of 20 sugar maple increment cores from a dieback area in Belvidere that was defoliated by forest tent caterpillar in 1980-82, showed that most trees with less than 25 percent crown dieback had begun a growth recovery in 1985 or 1986, following a dramatic slow-down in growth between 1982 and 1985.

Red Spruce Decline continues throughout the region, particularly on high-elevation sites. Spruce decline was aerially detected on 300 acres in Essex County. Red spruce, with 68 percent healthy, was the only conifer in hardwood stands that did not have near 90 percent of the dominant/codominant trees healthy during the Vermont Hardwood Tree Health Survey. Research being conducted by Don DeHays at the University of Vermont, shows that red spruce is much less genetically diverse than other conifers investigated and, therefore, may be less able to adapt to environmental changes.

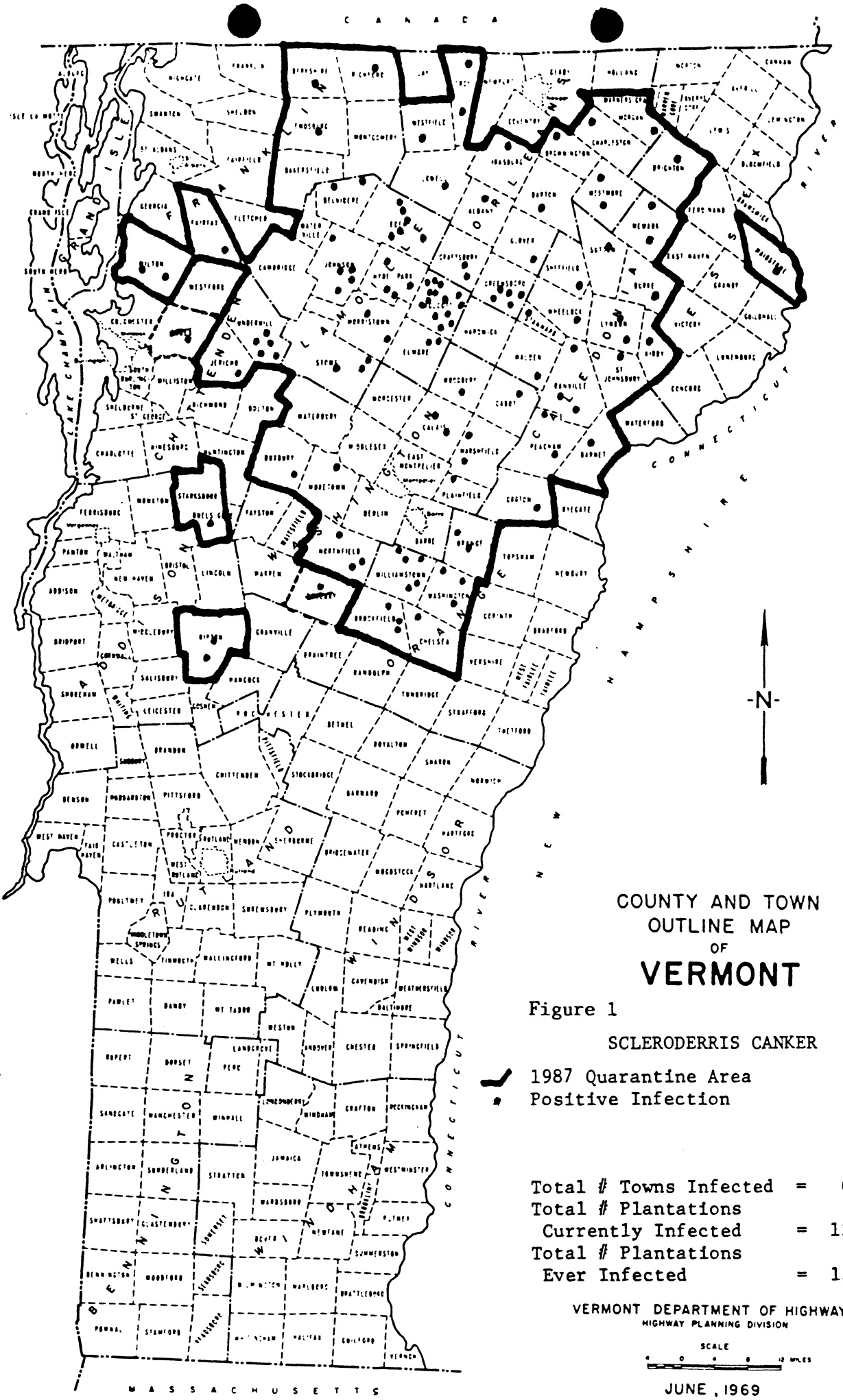
White Pine Needle Blight caused little noticeable damage for the second straight year except for some light damage in Orange County.

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS (N.O.=Not Observed)
Deer			N.O.
Grosbeaks			N.O.
Mouse			N.O.
Porcupine	Many	Scattered	Moderate damage to trees on private land in Marshfield from colony on state land. Populations building in District III
Sapsucker			N.O.
Squirrel	Maple Tubing Balsam Fir Seed at State Nursery	Widespread	A few complaints but damage down from past years. A 1986 survey conducted by D.Howard and N.Pelsue from the University of Vermont concludes that annual damage

ANIMAL DAMAGE

ANIMAL	SPECIES DAMAGED	LOCALITY	REMARKS (N.O.=Not Observed)
Squirrel (con't.)			to maple tubing systems in Vermont exceeds $200,000 (Agr. Exp. Sta. UVM Res. Rept. 52, June 1987)
Moose	Hardwoods	Worcester Elmore	Heavy bark stripping reported



COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT

Figure 1

SCLERODERRIS CANKER

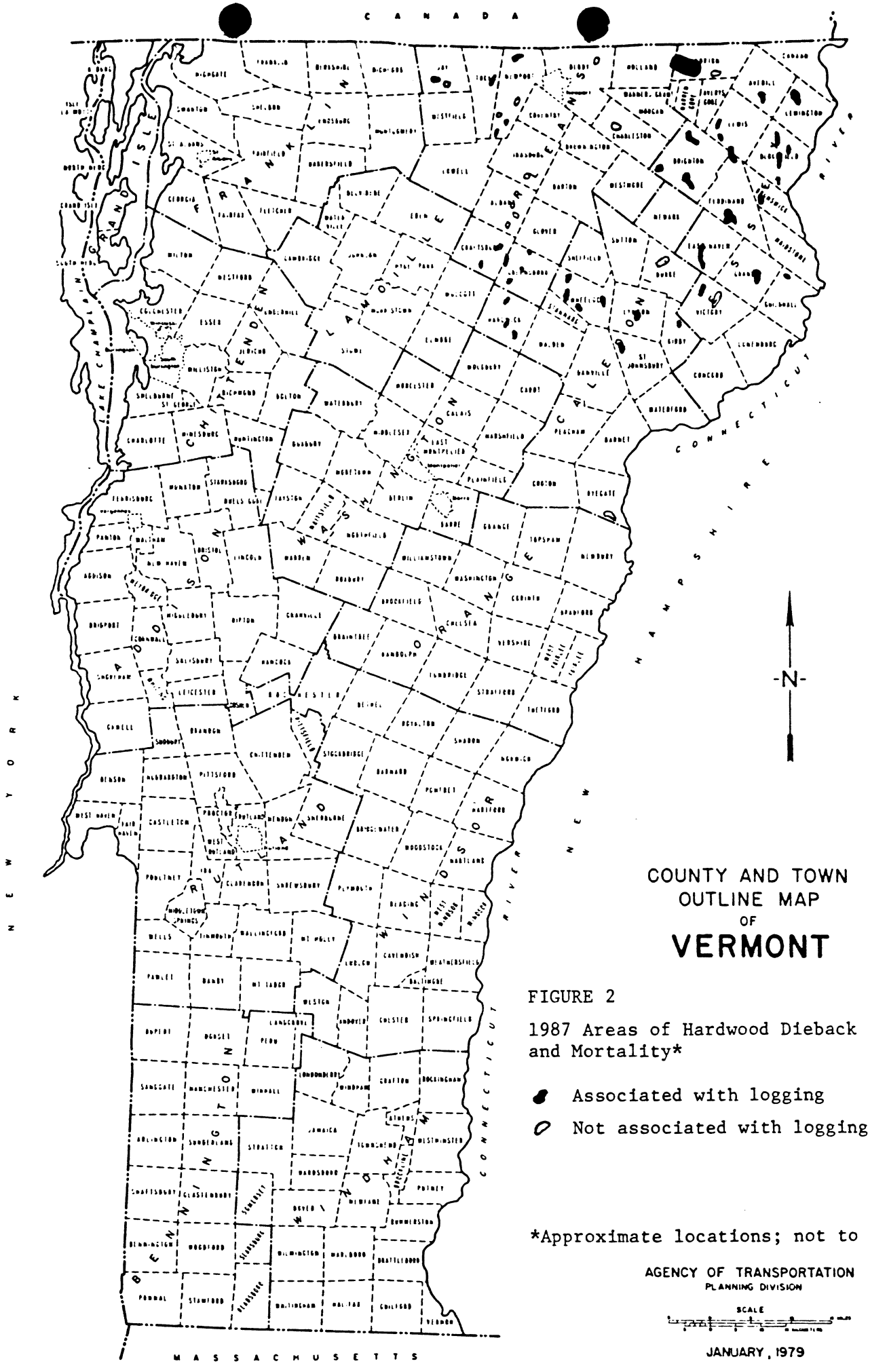
1987 Quarantine Area
Positive Infection

Total # Towns Infected	=	64
Total # Plantations Currently Infected	=	124
Total # Plantations Ever Infected	=	130

VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION

SCALE

JUNE, 1969



COUNTY AND TOWN OUTLINE MAP OF VERMONT

FIGURE 2

1987 Areas of Hardwood Dieback and Mortality*

- Associated with logging
- Not associated with logging

*Approximate locations; not to scale

AGENCY OF TRANSPORTATION
PLANNING DIVISION

SCALE

JANUARY, 1979